

METHOD OF ATTACHING RAIL CLIP ANCHORING DEVICE TO A
RAILWAY RAIL SUPPORT

5 The present invention relates to a method of attaching a rail clip anchoring device to a railway rail support, such as a railway sleeper or baseplate.

At present cast iron rail clip anchoring devices, or "shoulders", are attached to rolled steel baseplates using separate fasteners, for example bolts and nuts, or by welding. However, owing to the large number of shoulder/baseplate assemblies that are required it is desirable in order to reduce costs to fasten the shoulder to the baseplate without the additional expense of a separate fastening component. For the same reason it is also desirable to keep machining of either the baseplate or the shoulder to a minimum. Similar problems arise with attaching shoulders to steel sleepers.

20 According to a first aspect of the present invention there is provided a method of attaching a steel railway rail support to a ductile iron rail clip anchoring device, which method comprises:

25 inserting a boss, extending from the bottom of a body of the anchoring device, into a hole passing through the support at a location on its surface at which the anchoring device is to be attached until the anchoring device body abuts the support surface; and

30 compressing the steel around the hole in a region on the support surface opposite to that on which the anchoring device body is located, while the anchoring device is held in place, so that the compressed steel flows plastically against the boss within the hole, until the force thereby applied to the boss brings

about elongation thereof, whereby the boss undergoes an elastic set which clamps the boss to the support.

This method is quick and simple and has the additional advantages that (a) there is no requirement
5 for a separate fastening component, (b) there is no need to induce heat into either component, (c) there is no need to clean rust or scale from either component, and (d) the method can be performed with common metalworking tools. Furthermore, unlike methods which
10 simply hold the shoulder in place, a shoulder and support joined using this method must undergo stress reversal before they can be separated.

Preferably, the boss is provided with at least one recess in its flank and the compressed steel also flows
15 plastically into that recess. Desirably, the recess comprises a single non-helical groove extending around the boss. Alternatively, the flank of the boss may be provided with a plurality of recesses, each comprising a non-helical groove extending around the boss.

20 The step of compressing the steel around the hole is preferably performed by applying a penetrating tool, having a working face of desired shape, to the surface of the support opposite to that on which the anchoring device body is located until the tool has entered the
25 sleeper surface for a desired distance. The penetrating tool may be shaped to allow the said elongation of the boss.

The step of inserting the boss into the hole in the support may be performed by supporting the
30 anchoring device so that the boss extends upwardly and then lowering the support such that the boss passes through the hole.

Typically, the support will be provided with two such holes and the method will be carried out simultaneously with respect to both holes thereby to attach two anchoring devices to the support.

5 The or each hole may be punched into the steel support.

According to a second aspect of the present invention there is provided a rail clip anchoring device, for use with a method embodying the first
10 aspect of the present invention, which device has an anchoring device body and, extending from the bottom of that body, a boss provided with at least one recess in its flank, the recess comprising a single non-helical groove extending around the boss.

15 According to a third aspect of the present invention there is provided a railway rail fastening assembly comprising a steel railway rail support, having two holes therethrough, and two ductile iron rail clip anchoring devices, each anchoring device
20 having an anchoring device body and, protruding from the bottom of that body, a boss which extends into a respective one of the said holes in the support, the boss of each anchoring device having an elastic set whereby the boss is clamped to the support, wherein the
25 boss of at least one of the anchoring devices has at least one recess provided in its flank, the recess comprising a single non-helical groove extending around the boss. The boss may be provided with a plurality of recesses, each comprising a non-helical groove
30 extending around the boss.

The profile of the or each groove is preferably substantially that of a buttress thread. 15. The or

each recess is preferably provided adjacent a free end of the boss.

Reference will now be made, by way of example, to the accompanying drawings, in which:

5 Figures 1, 2 and 3 show in perspective respective simplified representations of a shoulder, a portion of a baseplate and a penetrating tool for use in a method embodying the first aspect of the present invention;

10 Figures 4 to 8 illustrate steps in a method embodying the first aspect of the present invention;

 Figure 9 shows a typical groove profile used in a shoulder embodying the second aspect of the present invention; and

15 Figures 10 to 12 show views of a baseplate/shoulder assembly produced using a method embodying the first aspect of the present invention.

 In a method embodying the first aspect of the present invention a ductile iron rail clip anchoring device, hereafter called a shoulder, is attached to a
20 steel baseplate. A simplified representation of a shoulder 1 is shown in Figure 1. The shoulder 1 is a ductile iron casting and has a body 10 from which there extends a cylindrical elongate boss 11 provided around its flank with a plurality of grooves 12 spaced along
25 its length, the first of the grooves 12 being adjacent to the free end 13 of the boss 11. The boss 11 may be of any length less than or equal to the thickness of the baseplate 2 to which the shoulder 1 is to be attached and can be of any cross-sectional shape,
30 although for ease of manufacture a cylindrical cross-section is preferred.

 A simplified representation of a portion of a rolled steel baseplate 2 to which the shoulder 1 of

Figure 1 may be attached is shown in Figure 2, the baseplate 2 having a throughhole 20 of cylindrical cross-section. Each baseplate 2 will have two such holes 20, preferably formed by punching through the baseplate 2, at locations corresponding to the desired positions of the respective shoulders 1 to be fastened to the baseplate 2. The baseplate 2 has a top face 2a and a bottom face 2b.

In a method embodying the first aspect of the present invention, as shown in Figure 4 firstly two shoulders 1 (only one shown throughout) are held in a fixture jig 4 (not shown in Figure 4) such that their respective bosses 11 extend upwardly. The baseplate 2 is then positioned, with its top face 2a facing downwards, as shown in Figure 5, such that the holes 20 therein slip over the bosses 11 and the top face 2a of the baseplate 2 makes contact with the respective bodies 10 of the shoulders 1. Using a press (not shown), for example a mechanical or hydraulic metal working press of around 200 ton (203.21 tonnes) capacity, a penetrating tool 3 is brought into contact with the bottom face 2b of the baseplate 2, as shown in Figure 6. As shown in Figure 3 the tool 3 is similar to a hollow punch, having a circular working face 30 and a void 31. The working face 30 of the tool 3 is chosen so as to be a little larger in diameter than the hole 20 in the baseplate 2 and in use is brought into contact with the region of the bottom face 2b of the baseplate 2 around the hole 20. As shown in Figure 7 the press forces the tool 3 against the bottom face 2b of the baseplate 2 until the shear strength of the baseplate material is exceeded, whereupon the working face 30 of the tool 3 penetrates the bottom face 2b for

a predetermined distance. As a result, steel in the region of the baseplate 2 where the tool 3 has penetrated flows plastically into the grooves 12 and exerts a compressive force against the flank of the boss 11 which acts in such a way that the boss 11 deforms, i.e. stretches. Since the boss 11 is constrained at one end by the body 10 of the shoulder 1 held in the fixing rig 4, the boss 11 can stretch only upwardly, towards the opening of the hole 20 in the bottom face 2b of the baseplate 2. The void 31 is provided in the tool 3 to allow for this to happen while the tool 3 is being pressed into the baseplate 2. The stretching of the boss 11 results in an elastic set in the boss 11, which remains after the penetrating tool 3 is backed off, and produces a restoring clamping force, similar to that provided by a bolt, which holds the shoulder 1 on the baseplate 2. This stress, acting normal to the baseplate surface 2a, must be overcome (reversed) before any load applied to the shoulder 1 can succeed in lifting the shoulder 1 from the baseplate 2. The assembled shoulder 1 and baseplate 2 are shown in Figures 8, 10 and 11. Retention of the shoulder 1 on the baseplate 2 is assisted by frictional resistance between the boss 11 and the baseplate material in contact with it, and by the steel forced into the grooves 12 in the boss 11 which is in shear at the interface between the boss 11 and the baseplate 2. Although Figure 1 and related Figures show a shoulder 1 having a plurality of grooves 12, a method embodying the first aspect of the invention could usefully employ a boss 11 without any grooves 12 or other recesses, in which case the clamping force between the shoulder 1 and baseplate 2 would not be as great. Preferably,

however, a boss 11 having a single, coarser groove may be used instead, as shown in Figure 12, and in fact such an arrangement is likely to be more effective than a plurality of grooves and would be easier to manufacture. Figure 12 shows a section through a baseplate 2, to which a shoulder 1 had been attached using a method embodying the first aspect of the present invention and has now been removed following cutting of the baseplate 2. An indent 22 left by the action of the penetrating tool 3 on the bottom face 2b of the baseplate 2 can be seen. A groove 12 having a modified buttress thread profile, where the direction of axial loading is opposite in direction to a normal buttress thread, is preferred, as shown in Figure 9. Typical values for the dimensions and angles of the groove 12 shown in Figure 9 are: $a=6.96\text{mm}$, $b=4.00\text{mm}$, $c=1.70\text{mm}$, $d=1.20\text{mm}$, $e=0.50\text{mm}$, $A=87^\circ$, $B=58^\circ$ and $C=35^\circ$.